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Bescheinigung

Certificate

Attestation

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The attached documents
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European patent application
described on the following
page, as originally filed.

Les documents fixés à
cette attestation sont
conformes à la version
initialement déposée de
la demande de brevet
européen spécifiée à la
page suivante.

Patentanmeldung Nr. Patent application No. Demande de brevet n°

99308340.1

PRIORITY DOCUMENT

SUBMITTED OR TRANSMITTED IN
COMPLIANCE WITH RULE 17.1(a) OR (b)

Der Präsident des Europäischen Patentamts;
Im Auftrag

For the President of the European Patent Office

Le Président de l'Office européen des brevets
p.o.

I.L.C. HATTEN-HECKMAN

DEN HAAG, DEN
THE HAGUE,
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Blatt 2 der Bescheinigung
Sheet 2 of the certificate
Page 2 de l'attestation

Anmeldung Nr.:
Application no.:
Demande n°: 99308340.1

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Date of filing:
Date de dépôt: 22/10/99

Anmelder:
Applicant(s):
Demandeur(s):
LUCENT TECHNOLOGIES INC.
Murray Hill, New Jersey 07974-0636
UNITED STATES OF AMERICA

Bezeichnung der Erfindung:
Title of the invention:
Titre de l'invention:

User registration and location management for mobile telecommunications systems

In Anspruch genommene Priorität(en) / Priority(ies) claimed / Priorité(s) revendiquée(s)

Staat:
State:
Pays:

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Date:

Aktenzeichen:
File no.
Numéro de dépôt:

Internationale Patentklassifikation:
International Patent classification:
Classification internationale des brevets:

H04L12/56, H04L29/06

Anmeldetag benannte Vertragsstaaten:
Contracting states designated at date of filing: AT/BE/CH/CY/DE/DK/ES/FI/FR/GB/GR/IE/IT/LI/LU/MC/NL/PT/SE
Etats contractants désignés lors du dépôt:

Bemerkungen:
Remarks:
Remarques:

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USER REGISTRATION AND LOCATION MANAGEMENT
FOR MOBILE TELECOMMUNICATIONS SYSTEMS

Background of the Invention

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This invention relates to user registration and location management for mobile telecommunications systems. In particular, it relates to Universal Mobile Telecommunications Service (UMTS) systems, when used to provide connectivity between an IP (Internet Protocol) capable end-device and an IP-based network.

10

When a UMTS user switches on his mobile terminal (MT), the user needs to be registered with the UMTS network. Similarly, when the user moves around the area covered by the network, location management procedures need to take place in order to allow the user to be provided with services.

15

The initial registration process normally involves requesting for registration on the network, authentication of the user by the network, registration of the user and informing the home location register (HLR) of the users current whereabouts. This takes place at the UMTS level.

20

At the IP (Internet Protocol) level, there are three scenarios to consider when the user switches on an IP capable terminal. These are:

25

- (1) the user has a static home IP address,
- (2) the user requires a dynamic home IP address from the UMTS operator, and
- (3) the user requires a dynamic home IP address from a body outside the UMTS domain.

30

In any case, a mobile IP registration with the home agent (HA) and

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perhaps the foreign agent (FA) needs to take place before the user can successfully engage in a data transaction using the Internet Protocol.

The current solution for the registration of data (IP) users in UMTS with mobile IP relies on the use of two, subsequent, registrations, the first at the UMTS level and the second at the IP level. This is shown in Figure 1.

The user of a mobile terminal switches on his mobile terminal MT1 and requires registration with the UMTS network. He sends a message 2 requesting registration which passes through a radio network controller (RNC) 3 (which may also be the foreign agent (FA) for the IP protocol) to a switching centre with a visiting location register (VLR) 4. This in turn requests user information from any previous visiting location register 5 which the user may have last received service from, or from the user's home location register (HLR) 6. This sends back information concerning the user to the new VLR 4 and then an authentication request 7 and reply 8 are sent to and received from the mobile terminal 1. After this authentication, registration of the mobile terminal is complete and a register complete message 9 is sent to the terminal. Also, a message 10 is sent to the HLR informing the HLR of the new location of the terminal.

If IP registration is also required, then a further IP registration step also has to take place with conventional systems.

Once UMTS registration is complete, the mobile terminal 1 sets up a UMTS data channel 11. The mobile terminal 1 sends an FA router solicitation message 12 to the new RNC/FA 3 and this in turn sends an FA advertisement 13 back to the mobile terminal over the data channel. The mobile terminal then sends a registration request which passes through the RNC/FA 3 and onwards to the home agent 14. This then sends back a registration reply 15 to the mobile terminal and IP registration is complete. The foreign agent FA in IP is analogous

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to the VLR (visiting location register) in the UMTS domain.

Accordingly, two independent registration processes are necessary, first the UMTS registration and then the IP registration.

5

When a UMTS user moves around the area covered by the network, location management procedures need to take place in order to allow the user to be provided with services. Location management under a single radio network controller (RNC) does not affect the IP level. However, inter-RNC location updates have to involve IP level mobility as well as UMTS mobility. This is because it is assumed that mobile IP foreign agents (FA's) and RNC's are co-located.

Conventionally, an analogous process to the conventional method of registration has been done. Firstly UMTS location update is done and then, independently, a subsequent IP location update is done. This is shown in Figure 2.

The location update procedures are similar in principle to the registration updates of Figure 1, except that the location update 16 is required for both IP and UMTS, rather than register updates. Apart from this, the procedures involve similar steps, mutatis mutandis.

In both the user registration and location management scenarios, the complete separation of the two procedures for UMTS and IP bring inefficiencies in the usage of the air-interface, and delays to the overall registration or location update procedure.

The present invention arose in an attempt to reduce these inefficiencies and to reduce the time taken for the overall registration procedure or for the

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overall location update procedure.

Brief Summary of the Invention

5 According to the present invention in a first aspect there is provided a method of use of a UMTS telecommunications network, comprising utilising UMTS signalling to indicate changes in an IP sub-network.

10 According to the present invention in a second aspect there is provided a method for a mobile terminal associated with a UMTS telecommunications network to register its position and/or update its location with regard to UMTS and IP registration, comprising integrating UMTS and IP procedures.

15 Mobile-IP specifications allow for link-layer mechanisms to be used to discover a foreign agent (FA) or to detect a change in the sub-network. In a preferred embodiment of the invention, accordingly, the UMTS level mobility-management (link-layer) is used for FA discovery.

20 More specifically, the method may comprise using UMTS 'register request' and 'register complete' messages for detecting FA information.

 Preferably, additional fields of information are sent with the 'register req' message and with the 'register complete' message.

25 The fields which may be sent with the 'register req' message are: (1) type of home address, (2) type of COA (care of address), (3) home IP address, (4) home agents address, and (5) last used COA.

30 The additional field for the 'register complete' messages may be (1) home address, (2) COA type and (3) COA.

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In further embodiments relating to location management, the UMTS 'location update' and 'location update complete' messages may be used.

Preferably, extra fields of information are provided in one or both of these messages. The fields which may be attached to the 'location update' message are: (1) home address, (2) COA type and (3) COA.

The extra fields which may be attached to the 'location update complete' message may comprise any of (1) type and (2) COA.

10

Description of the Drawings

Embodiments of the invention will now be described, by way of example only, with reference to the accompanying drawings in which:

15

Figure 1 shows UMTS and IP registration procedures according to the prior art;

Figure 2 shows UMTS and IP location update procedures according to the prior art;

20

Figure 3 shows an integrated registration procedure according to the present invention; and

Figure 4 shows an integrated location update procedure according to the present invention.

25

Detailed Description of Preferred Embodiments of the Invention

30

Referring to Figure 3, in embodiments of the invention, the UMTS level mobility-management (link-layer) may be used for FA discovery. Accordingly, the UMTS 'register req' and 'register complete' messages are used for discovering the FA care-of-address (COA) or obtaining a co-located COA for a mobile terminal. Thus, in the Figure, when a mobile terminal 1 requires to

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register with a network, it sends out a modified register request message 30 with the addition of various IP related fields.

These fields are:

- 5
- (1) type of home address
 - (2) type of COA
 - (3) home IP address (optional)
 - (4) home agents address (optional)
 - (5) last used COA (optional)

10

Note that if the mobile terminal 1 is not IP capable, then the additional fields are not used.

More particularly, the fields are the following:

- 15
- (1) Type: this field identifies to the network if the mobile terminal 1 has a static address or requires a dynamic address from the UMTS operator, or requires a dynamic address from an entity outside the UMTS domain.
 - (2) Type of COA: this identifies if the mobile terminal is to use a co-located COA or a FA, the address in the COA field depends upon this setting.
 - (3) Home address: if the mobile is configured with a static home address, this field identifies that address. If the mobile does not have a statically configured home address, this field is omitted.
 - (4) Home agent: if the mobile has been configured statically with its home agent address, this field identifies it. Otherwise, this field is omitted.
 - (5) Last used COA: this field contains the mobile's last used COA, if any. Otherwise this field is omitted.

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The 'register req', with attached IP fields is functionally similar to the FA router solicitation 12 of Figure 1.

The 'register complete' message is, from the IP perspective, the FA advertisement. The additional IP fields in the 'register complete' message are:

- (1) home address: home address of the user
- (2) type: the type of COA used at present, co-located or foreign agent (FA)
- (3) COA: the COA.

10

If the user does not have a static address and the UMTS network could not obtain a home address for the user, then the user will be required to use IP level mechanisms to obtain one. The UMTS network will, however, issue the user with the address of the FA or the co-located COA.

15

Subsequent to the register complete message 32, the mobile then uses a UMTS data channel to send a mobile-IP registration message 33 to the FA (or direct to the HA in case of a co-located COA). This procedure takes place at the IP level, where a data channel 34 is set up over the UMTS radio interface for carrying IP control messages. The HA (or FA) then transmits a registration reply message 35.

20

Figure 4 shows an embodiment of the invention representing an integrated procedure for location management with mobile IP and UMTS. The procedure differs from that of the prior art in that the mobile terminal 40, in its 'location update request' transmission 41 also includes one or more extra fields. The fields are:

25

- (1) home address: home address of the user
- (2) type: the type of COA used at present, co-located or foreign agent (FA)

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(3) COA: the COA.

An authentication routine then follows and, once the UMTS level location update is successfully completed, the RNC/FA checks whether a new COA needs to be issued. They can do this because of the information that was presented by the mobile terminal 40 in the 'location update request' message 41. If a new COA needs to be issued, it is attached to a "location update complete" message 42. The extra fields of information required within this message are (1) type and (2) COA. This message is used by the mobile terminal 40 at the IP level, as detection for mobile IP. A data channel is set up and the mobile terminal decides what it needs and whether it needs to do anything in relation to registering with a new FA and HA and this takes place at a registration request step 44. The mobile terminal registers either with a new RNC/FA 46 and with the home agent (HA) 47. If route optimisation is enabled, then the new FA will re-register the user at the old FA.

Embodiments of the invention accordingly allow a reduction in signalling messages that have to be transmitted across the air interface, during registration or during an inter-RNC location update, and minimise the delay required to complete such location updates. In effect, therefore, valuable network resources are saved and overhead is reduced.

Embodiments of the invention in general utilise UMTS signalling for detecting changes in the IP sub-network and integration of IP level signalling and UMTS level signalling. The invention may have wider use than the two specific scenarios described (user registration and location management) and may be applied to other scenarios where IP signalling is required.

Mobile IP information is sent during UMTS signalling for the reasons described above.

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CLAIMS

1. A method of use of a UMTS telecommunications network, comprising utilising UMTS signalling to indicate changes in an IP sub-network.

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2. A method for a mobile terminal associated with a UMTS telecommunications network to register its position and/or update its location with regard to UMTS and IP registration, comprising integrating UMTS and IP procedures.

10

3. A method as claimed in Claim 2, comprising a method for a mobile terminal to register its position with regard to UMTS and IP registration, the method comprising using UMTS 'register request' and/or 'register complete' messages for detecting IP information.

15

4. A method as claimed in Claim 3, wherein fields of information relevant to the IP domain are sent with the 'register req' message.

5. A method as claimed in Claim 4, wherein the fields (in case the mobile terminal is IP capable) are: (1) type of home address, (2) type of care of address (COA), and, optionally, any of the following: (3) home IP address, (4) home agents (HA) address and (5) last used COA.

20

6. A method as claimed in Claim 5, wherein additional fields of information are sent with the 'register complete' message.

25

7. A method as claimed in Claim 6, wherein the fields comprise (in case the mobile terminal is IP capable) (1) home address, (2) COA type and (3) COA.

30 8. A method as claimed in any preceding claim, comprising a method for a

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mobile terminal to update its location, wherein the method comprises using UMTS 'location update' and/or 'location update complete' messages to detect IP information.

- 5 9. A method as claimed in Claim 8, wherein additional fields of information relevant to the IP domain are sent with the 'location update' message.,
- 10 10. A method as claimed in Claim 9, wherein the additional fields comprise (in case the mobile terminal is IP capable) (1) home address, (2) COA type and (3) COA.
11. A method as claimed in any of Claims 8 to 10, wherein additional fields are sent with the 'location update complete' message.
- 15 12. A method as claimed in Claim 11, wherein the additional fields comprise (in case the mobile terminal is IP capable) (1) type and (2) COA.
- 20 13. A method of using a UMTS communication network, substantially as hereinbefore described with reference to, and as illustrated by, Figures 3 and 4 of the accompanying drawings.

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ABSTRACTUSER REGISTRATION AND LOCATION MANAGEMENT
FOR MOBILE TELECOMMUNICATIONS SYSTEMS

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A method of use of a UMTS telecommunications network, comprising
utilising UMTS signalling to indicate changes in an IP sub-network. To register a
Mobile Terminal (MT) or to update its location within the network, signalling
relevant to the IP domain is transmitted with UMTS signalling in an integrated
10 approach. This reduces the number of signalling messages that are required and
minimises delays.

[Figure 3]

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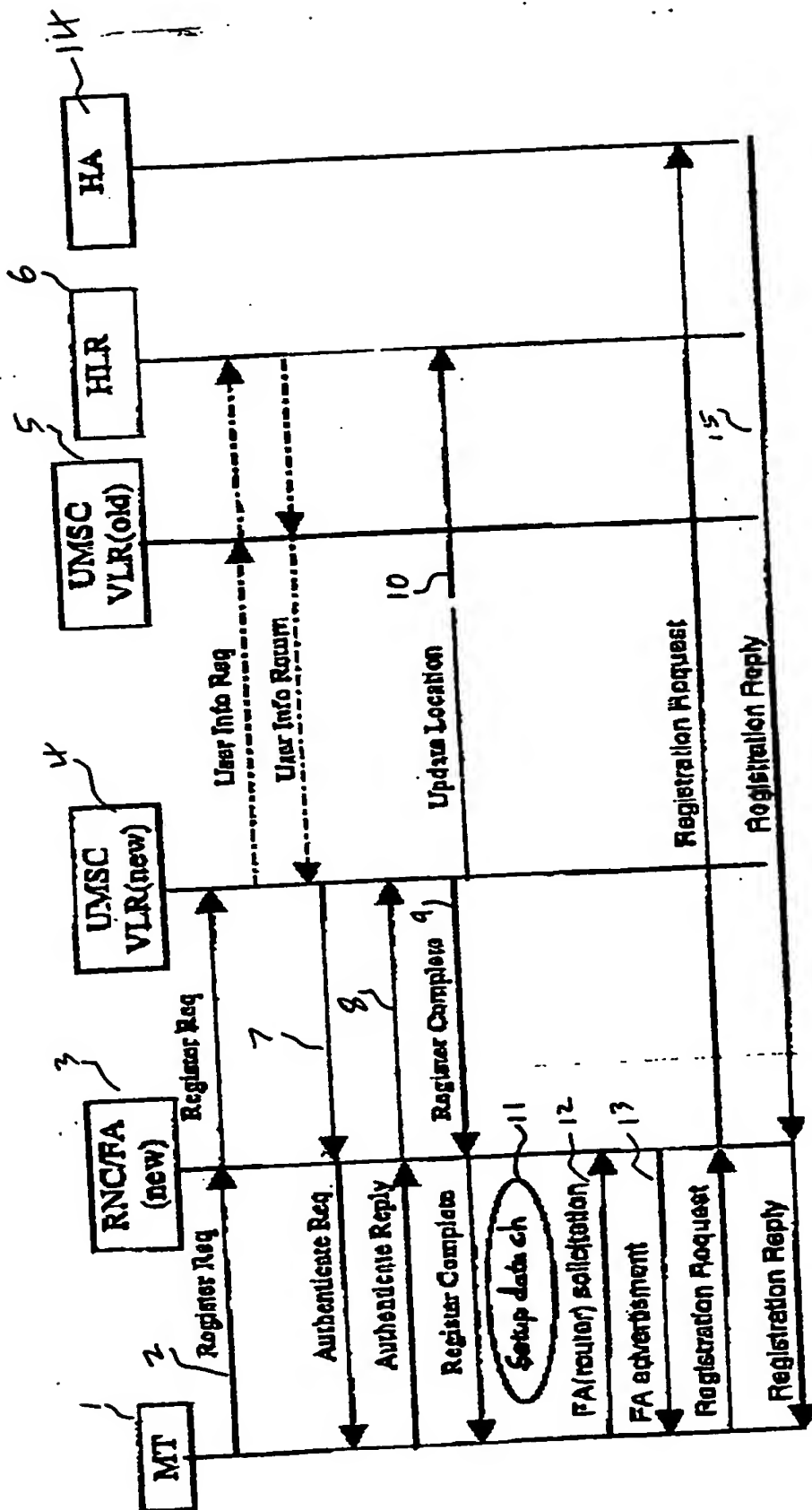


FIG 1

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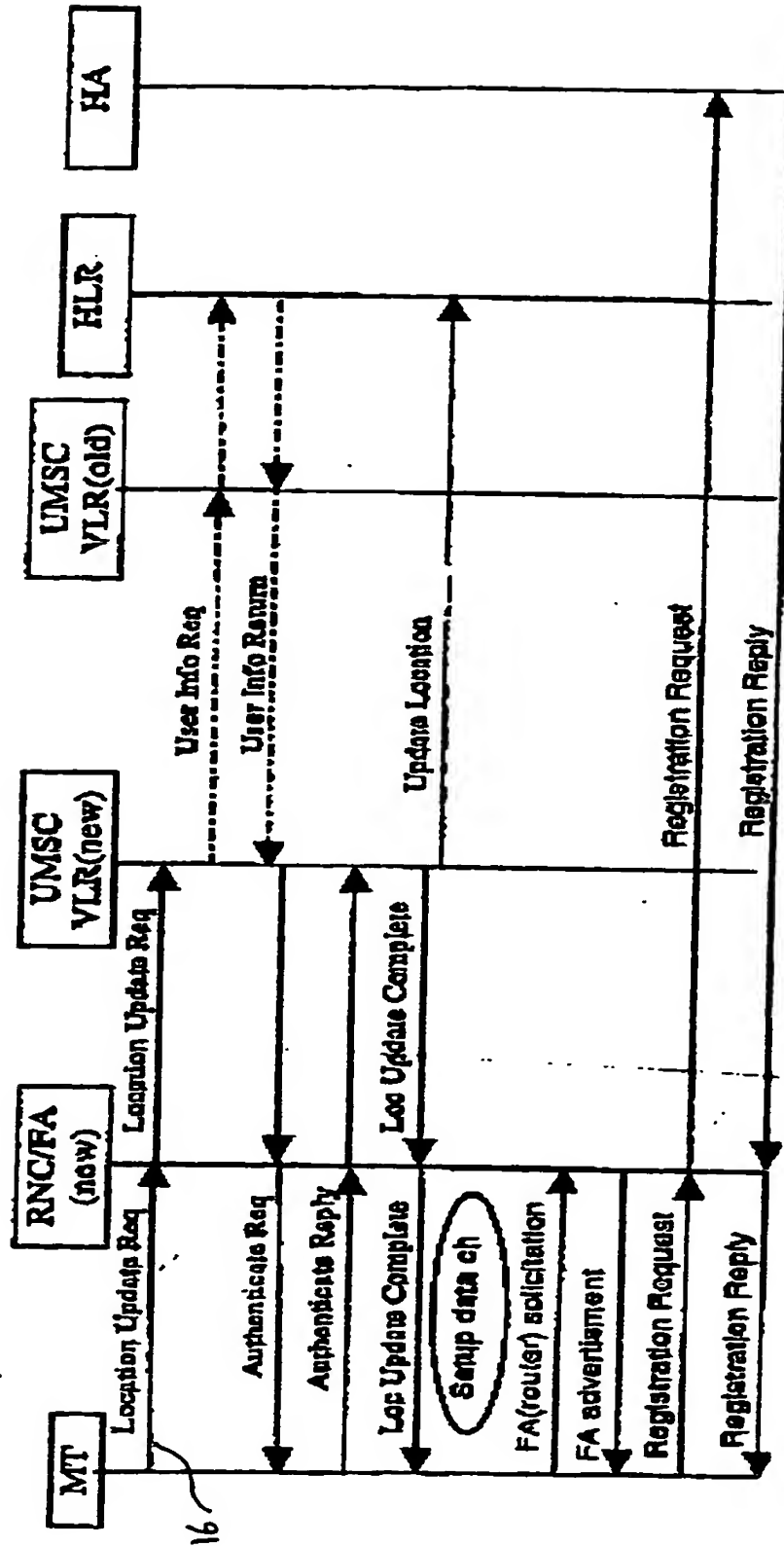


FIG 2

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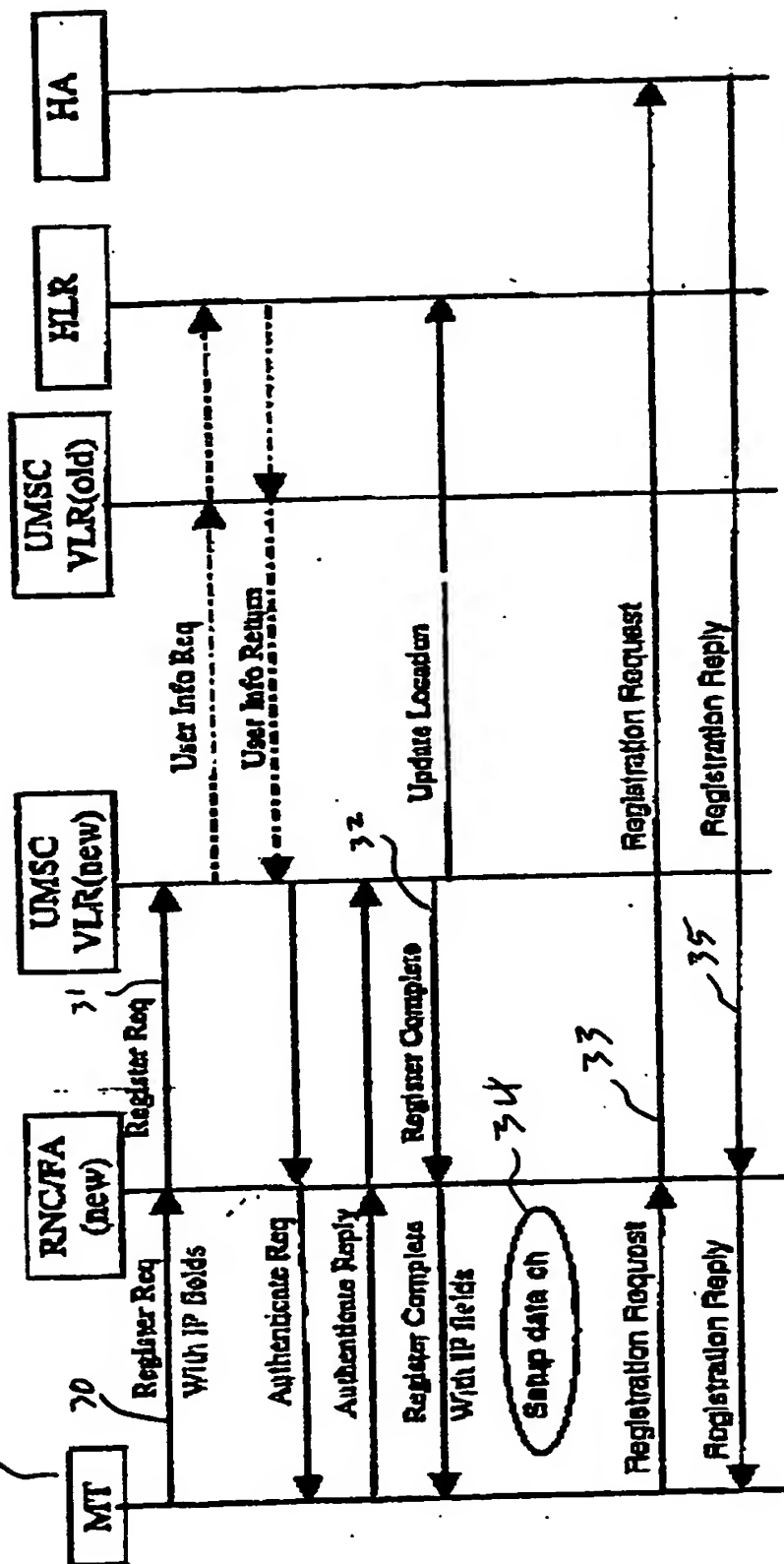


FIG 3

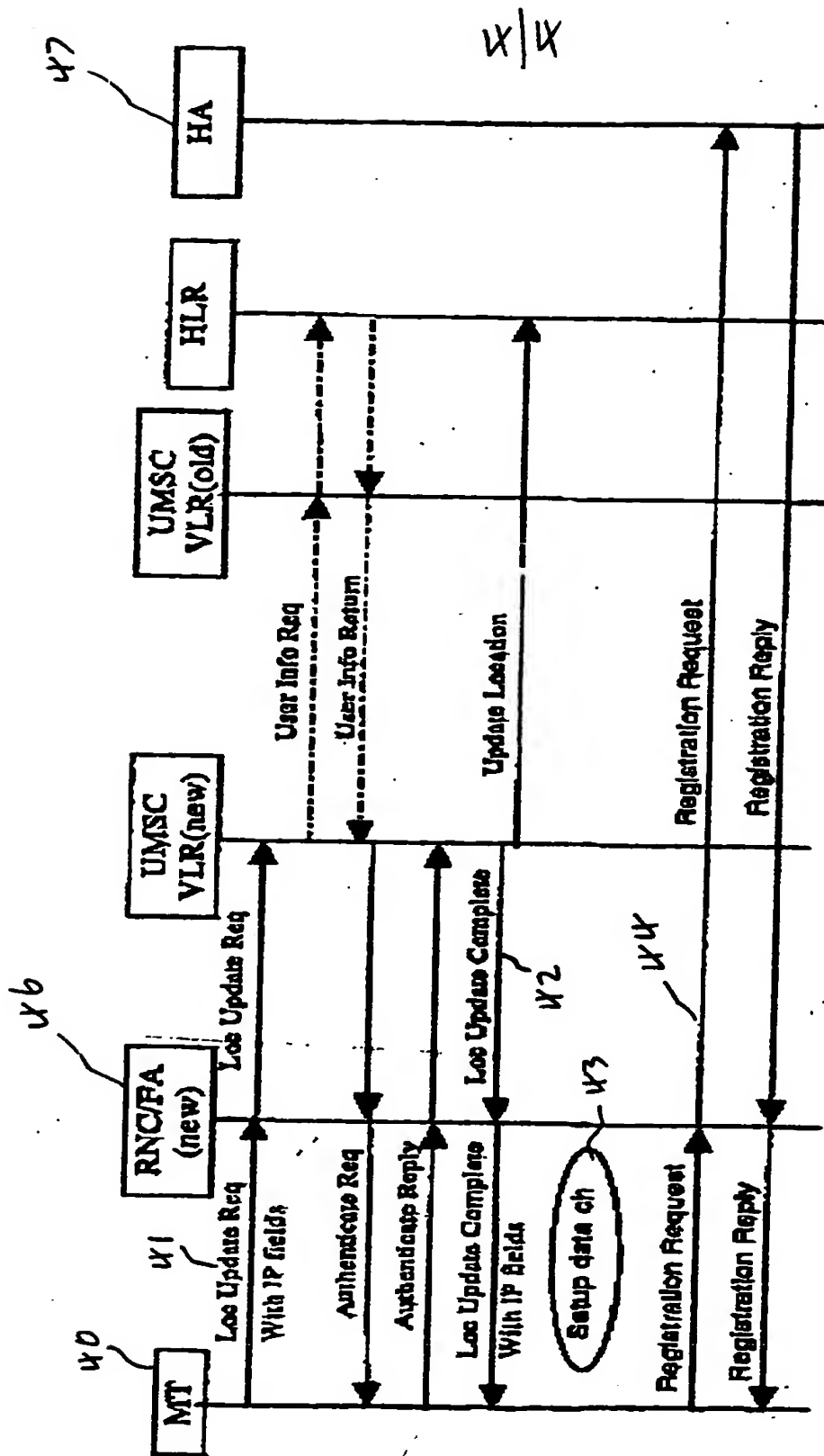


FIG 4

INTERNATIONAL SEARCH REPORT

Internal Application No

PCT/EP 00/05705

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H04L12/56 H04L29/06

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 H04L H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ, INSPEC, COMPENDEX

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	CLAPTON A J ET AL: "UMTS - THE MOBILE PART OF BROADBAND COMMUNICATIONS FOR THE NEXT CENTURY" BT TECHNOLOGY JOURNAL, GB, BT LABORATORIES, vol. 16, no. 2, 1 April 1998 (1998-04-01), pages 120-131, XP000750524 ISSN: 1358-3948 page 127, column 1, line 9 - line 13 page 130, column 1, line 23 - line 39 --- -/--	1,2

☒ Further documents are listed in the continuation of box C.

☐ Patent family members are listed in annex.

* Special categories of cited documents :

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier document but published on or after the international filing date
- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

- "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- "&" document member of the same patent family

Date of the actual completion of the international search

1 November 2000

Date of mailing of the international search report

14/11/2000

Name and mailing address of the ISA

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Tous Fajardo, J

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INTERNATIONAL SEARCH REPORT

International Application No

PCT/EP 00/05705

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	<p>ACHARYA A ET AL: "MOBILITY SUPPORT FOR IP OVER WIRELESS ATM"</p> <p>IEEE COMMUNICATIONS MAGAZINE, US, IEEE SERVICE CENTER. PISCATAWAY, N.J., vol. 36, no. 4, 1 April 1998 (1998-04-01), pages 84-88, XP000752575</p> <p>ISSN: 0163-6804</p> <p>page 86, column 2, line 36 -page 87, column 1, line 12</p> <p>---</p>	1
A	<p>MITTS H ET AL: "A SIMPLE AND EFFICIENT ROUTING PROTOCOL FOR THE UMTS ACCESS NETWORK"</p> <p>JOURNAL OF SPECIAL TOPICS IN MOBILE NETWORKS AND APPLICATIONS, BALTZER SCIENCE PUBLISHERS, AMSTERDAM, NL, vol. 1, 1996, pages 167-181, XP000750011</p> <p>ISSN: 1383-469X</p> <p>page 169, column 1, line 32 -page 170, column 1, line 28</p> <p>-----</p>	1,2

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PATENT COOPERATION TREATY

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REC'D 21 JAN 2002

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

7

Applicant's or agent's file reference M.COSTA 5-3-		FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
International application No. PCT/EP00/05705	International filing date (day/month/year) 20/06/2000	Priority date (day/month/year) 22/10/1999
International Patent Classification (IPC) or national classification and IPC H04L12/56		
Applicant LUCENT TECHNOLOGIES INC		



- This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.
- This REPORT consists of a total of 5 sheets, including this cover sheet.

☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

 These annexes consist of a total of 3 sheets.

- This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☐ Certain defects in the international application
- VIII ☐ Certain observations on the international application

Date of submission of the demand 05/02/2001	Date of completion of this report 17.01.2002
Name and mailing address of the international preliminary examining authority:  European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer Kappatou, E Telephone No. +49 89 2399 7521 

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INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/EP00/05705

I. Basis of the report

1. With regard to the **elements** of the international application (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17)*):
- Description, pages:**

1-3,5-8	as originally filed			
4	as received on	04/12/2001	with letter of	28/11/2001

Claims, No.:

1-11	as received on	04/12/2001	with letter of	28/11/2001
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Drawings, sheets:

1/4-4/4	as originally filed
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2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

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**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT**

International application No. PCT/EP00/05705

- ☐ the description, pages:
☐ the claims, Nos.:
☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	1-11
	No:	Claims	
Inventive step (IS)	Yes:	Claims	1-11
	No:	Claims	
Industrial applicability (IA)	Yes:	Claims	1-11
	No:	Claims	

- 2. Citations and explanations
see separate sheet**

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Re Item V

Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. The subject-matter of claim 1 is new and involves an inventive step, Article 33(2)(3) PCT.
 - 1.1 Claim 1 refers to a method for a mobile terminal in a UMTS and IP network to register and/or update its location.
 - 1.2 Such a method is known from document D1: CLAPTON A J ET AL: 'UMTS - THE MOBILE PART OF BROADBAND COMMUNICATIONS FOR THE NEXT CENTURY' BT TECHNOLOGY JOURNAL, GB, BT LABORATORIES, vol. 16, no. 2, 1 April 1998, pages 120-131, XP000750524 ISSN: 1358-3948.
 - 1.3 The subject-matter of claim 1 differs from the disclosure of D1 in the additional using UMTS messages to transmit the IP information needed for the IP registration and/or IP location update.
 - 1.4 The problem to be solved by the present invention may therefore be regarded as making the registration and update of location for a mobile terminal of a UMTS and IP network more efficient.

By sending the needed IP information in UMTS messages, the number of signalling messages transmitted over the air interface are reduced and the delay related to it is minimised.

2. The solution proposed cannot be derived from the cited prior art.
 - 2.1 Document D1 refers to the need to increase efficiency over the air interface of the UMTS with mobile IP but proposes an interaction with IN.
 - 2.2 Document D2: ACHARYA A ET AL: 'MOBILITY SUPPORT FOR IP OVER WIRELESS ATM' IEEE COMMUNICATIONS MAGAZINE, US, IEEE SERVICE CENTER. PISCATAWAY, N.J, vol. 36, no. 4, 1 April 1998 (1998-04-01), pages

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**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/EP00/05705

84-88, XP000752575 ISSN: 0163-6804, refers to IP over mobile ATM and does not deal with the problem posed. In fact, it discloses that mobility is transparent to the mobile IP, with no location updates at the mobile IP level.

- 2.3 Document D3: MITTS H ET AL: 'A SIMPLE AND EFFICIENT ROUTING PROTOCOL FOR THE UMTS ACCESS NETWORK' JOURNAL OF SPECIAL TOPICS IN MOBILE NETWORKS AND APPLICATIONS, BALTZER SCIENCE PUBLISHERS, AMSTERDAM, NL, vol. 1, 1996, pages 167-181, XP000750011 ISSN: 1383-469X, is less relevant.
3. Claims 2 to 11 are dependent on claim 1 and as such also meet the requirements of the PCT with respect to novelty and inventive step.

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